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Contents

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Control of the Sweetpotato Weevil in Planting Material

L. H. ROLSTON, T. B. BARLOW AND E. G. RILEY[1]

The crux of the sweetpotato weevil[2] problem in southern Louisiana is control of the weevil in planting material. Most growers produce their own plants to economize and to have an adequate supply of viable plants on hand when they need them. Where the sweet potato weevil is endemic, as it is in many Louisiana parishes where sweet potatoes are grown, precautions should be taken to keep planting material free of infestations.

A plant production program typical among growers begins with certified or foundation sweet potatoes. These are increased the first year, and their progeny provide plants for production fields the second year. The initial stock of certified or foundation sweet potatoes usually goes into farm storage for a few months before bedding. Plants from these sweet potatoes are set in an increase field, and the yield from this field remains in farm storage from harvest in the fall until bedding time the next year. The bedding or "seed" sweet potatoes may become weevil-infested during either storage period.

There are several potential sources of weevil infestation in storage. The storage house may have a residual infestation at harvest from sweet potatoes stored there earlier, and adult weevils may be carried in inadvertently along with sweet potatoes or otherwise gain entrance into the storage house. Also, some of the sweet potatoes may be infested at harvest with immature stages of the weevil. Means of preventing or eliminating infestations from each of these potential sources were investigated in studies conducted at Baton Rouge from 1976 to 1981.

Sweet potato storage houses on farms are normally empty from bedding time in the spring until harvest in the fall, but when the sweet potatoes are removed for bedding a few sweet potatoes and many fibrous roots usually remain. The fibrous roots were of particular concern because it is difficult to clean all of them from a storage house and because it was not known if these fibrous roots would sustain weevils through the summer. One experiment was addressed to this question.

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[2]*Cylas formicarius elegantulus* (Summers). Coleoptera:Cuculionidae. The ESA official common name of this insect is written with sweet potato as one word.

Since adult weevils are quite active, crawling about the walls and floor of an infested storage house as well as among the sweet potatoes, it seemed probable that a residual spray on the interior surfaces of the storage house would be useful as a control measure against adult weevils gaining entrance either through their own efforts or on sweet potatoes or equipment taken into the storage house. The residual spray should also control the smoky brown roach,[3] which may become a nuisance in storage houses, and it should leave no residue on the sweet potatoes. Several insecticides were evaluated as a residual treatment.

Although the use of Imidan as a protective dust applied at harvest has become general practice, its effect on infestations of eggs and larvae already within sweet potatoes at the time of treatment and the persistency of its effectiveness against adult weevils were unknown. Both of these aspects of the treatment are relevant to control of the sweet potato weevil in storage and both were investigated.

Occasionally a grower is short of bedding sweet potatoes because of some mishap or miscalculation. Then he usually buys sweet potatoes for bedding from any available source even though the sweet potatoes are or may be weevil-infested. In such cases weevil control must be focused on the plant beds. Various insecticides were applied at the time of bedding to test their effectiveness as a barrier between infested bedding sweet potatoes and the plants produced by them.

Even though bedding sweet potatoes are uninfested, and plant beds are isolated as far as practicable from potential sources of infestation, some adult weevils may fly into plant beds. Since plant beds occupy a small area relative to the area planted from them, foliar applications of an insecticide to plant beds is a reasonable added precaution against weevil infestation. Several insecticides were tested as foliar applications for their efficacy against adult weevils in plant beds.

A final precaution against transporting weevil eggs and larvae from plant beds to fields is cutting plants rather than pulling them. This practice has long been advocated, but its effectiveness had not been documented.

The objective of the work reported here has been to design a control program which will result in plants that are free of weevils when they are set in the field. Some unpublished work on insecticidal control of the sweet potato weevil and biological studies of this insect contributed to this objective (*1*, *2*).[4]

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[3]*Periplanta fulginosa* (Serville). Orthoptera:Blattidae.

[4]Italic number in parentheses refer to Literature Cited, page 12.

Methods

Survival

Survival of adult weevils in a double walled wooden storage house in July was determined for weevils of unknown age and sex taken from a culture. A total of 130 individuals for each of three treatments were initially divided into lots of 10 individuals. Each lot was confined in a 1-quart, cylindrical, cardboard container the top of which was covered by a double layer of cheese cloth. A sweet potato of the Centennial variety was provided in each container of the control treatment, fibrous roots from sweet potatoes of the same variety were supplied to weevils in the "fibrous root" treatment, and no plant material was available to weevils in the "no food" treatment. Weevils were observed daily for mortality, and temperatures were recorded continuously on a thermograph.

Residues

Strips of unpainted pine measuring about 1 x 6 x .125 inches were dipped into emulsions or suspensions of insecticide, drained of excess liquid, and air-dried. Lower rates of each insecticide were obtained by diluting the highest rate. At 1, 7, 14, 21, and 28 days after treatment, each strip was placed in a 1-quart, cylindrical, cardboard container together with 10 weevils of unknown age and sex from a culture. The container was closed by a double layer of cheese cloth. Mortality was determined a day later, using inability to walk as the criterion for mortality. The experiment contained 10 replications.

Sweet potatoes were tested for acquisition of residue in a malathion-treated storage house. All interior surfaces of a wooden storage house were thoroughly sprayed with .625 pounds of malathion (1 pint of 5EC formulation) in 2½ gallons of spray. The sweet potatoes were placed in storage as soon as the spray dried. Residue samples were taken at each corner and along two walls from crates on the floor, next to the ceiling, and halfway between the floor and ceiling at 1, 3, and 7 days after treatment. Chemical analyses sensitive to .005 ppm were performed under the direction of E. A. Epps, Jr. of the Feed and Fertilizer Laboratory.

Weevil emergence after Imidan treatment

A dip rather than a dust was used in this and the following experiment to assure complete and uniform coverage of the sweet potatoes. To calculate the concentration of Imidan 50W in a dip that would result in a dosage equivalent to 3 ounces of Imidan 5D, an estimate was made of the amount of dip adhering to clean sweet potatoes. This estimate was obtained by noting the reduction in water volume after a known weight of sweet potatoes was dipped in a measured amount of water. The loss averaged 500 ml per 50-pound bushel. Since 3 ounces of Imidan 5D contains 4.253 grams of toxicant, twice this weight of Imidan 50W was added to each 500 ml of water, the amount estimated to adhere to a 50-pound bushel of clean sweet potatoes.

Centennial sweet potatoes used in this experiment were exposed in bulk for 2 days to 10 female weevils per sweet potato. Check samples and samples for treatment were drawn from the bulked lot, the latter at 5-day intervals from the 5th to 35th day after exposure to weevils. The sweet potatoes were held individually at about 85°F until emergence of weevils ceased.

Each treatment was replicated three times, and each replication of a treatment consisted of five sweet potatoes.

Persistance of Imidan treatment

Each of four varieties of sweet potatoes were divided into two lots. One lot of each variety was treated with Imidan as in the previous experiment, and the other lot was left untreated as a check. Both lots were stored at about 65°F. At 12, 66, and 99 days after treatment, a sample of 10 sweet potatoes was taken from each lot of each variety. Each sweet potato was caged separately with 10 weevils of unknown sex that had emerged from a culture within the past 2 weeks. Mortality was observed and punctures counted after a holding period of about 24 hours at about 80°F.

Insecticides applied at bedding

This experiment was conducted out of season, in June, because heavily infested sweet potatoes bedded in early spring rotted in the relatively cool soil and produced no plants. Centennial sweet potatoes were exposed to adult weevils for 3 weeks then treated with a fungicide. These sweet potatoes were laid in furrows over which the treatments were applied in an 18-inch band. Insecticide falling on the sides of the furrows was incorporated into the soil above the sweet potatoes when the sweet potatoes were covered with a disk hiller. As plants began emerging, cages were placed over each plot to prevent movement of weevils among plots. When plants reached a size suitable for setting, a sample of 25 plants was pulled from each cage and the remaining plants were discarded. One additional sample set was taken when plants of suitable size again became available. All samples were examined microscopically for eggs and young larvae.

A randomized complete block design with four replications was employed. Each plot consisted of a single row 10 feet long.

Foliar sprays on plant bed

Insecticides were applied to a plant bed of the Centennial variety after plants had emerged, and again 1 week later, using sprays at the rate of about

100 gallons per acre. On the third and fifth day after each application, 30 weevils of unknown sex were released in each plot. A sample of 10 slips was taken from each plot a week after the last application and examined microscopically for eggs and larvae.

The experimental design was a randomized complete block with six replications. Each plot consisted of a single row 10 feet long.

Cut vs. pulled plants

Six samples of 10 slips each and six samples of 10 cut plants each were taken from untreated plots in a soil insecticide experiment in a plant bed established with heavily infested Centennial sweet potatoes. Paired samples, one of slips and one of cut plants, were taken from each replication. Plants in the samples were examined microscopically for weevil eggs and larvae.

Results

Survival

Without food the most tenacious weevil survived only 5 days at ambient summer temperatures (Table 1). Weevils confined with dry, fibrous sweet potato roots lived no longer than weevils that had no plant material available to them.

Table 1.—Survival of adult sweetpotato weevils provided with sweet potatoes of marketable size (control), fibrous sweet potato roots, and with no food in storage during summer

	Percent survival		
Days	Control	Fibrous roots	No food
1	100	100	100
2	99	87	90
3	97	35	56
4	97	3	12
5	95	1	1
6	92	0	0

Temperatures: min. 72, max. 93; avg. min. 82, avg. max. 89; avg. 86

Residues

Of the six insecticides evaluated for their residual effectiveness when applied to wooden surfaces, both Furadan and malathion killed within a day at least 92 percent of the adult weevils exposed to them. The effectiveness of these residues was undiminished through the 4 weeks of testing

(Table 2). During the exposure period, the weevils had a choice of treated or untreated surfaces upon which to walk or rest. The few weevils surviving exposure to residues of these two insecticides may not have come in contact with the residues.

No malathion was detected by analysis sensitive to .005 ppm in crated sweet potatoes placed in a storage house that had been treated by thoroughly spraying all interior surfaces with .625 pounds of malathion in 2½ gallons of spray.

Table 2.—Percent mortality of adult sweetpotato weevils after one day exposure to residues of various ages on wood.

Treatment		Age of residue (days)				
Insecticide	Rate[1]	1	7	14	21	28
Furadan, 4F	0.5	100	100	100	100	100
	0.25	100	100	100	100	98
Malathion, 5E	6.0	98	97	100	100	99
	3.0	94	100	99	98	96
	1.5	92	98	98	98	98
Mocap, 3E	6.0	100	100	100	84	—
	3.0	100	100	96	86	—
	1.5	100	100	90	70	—
Dyfonate, 4E	4.0	100	100	100	84	—
	2.0	96	88	—	—	—
	1.0	98	78	—	—	—
Imidan, 70W	2.0	86	—	—	—	—
	1.0	68	—	—	—	—
Thiodan, 50W	4.0	66	—	—	—	—
	2.0	48	—	—	—	—
Control	—	0.3	0.6	0	1.8	0.9

[1]Pounds active ingredient per 100 gallons.

Weevil emergence after Imidan treatment

When samples were taken at 5-day intervals from sweet potatoes exposed for 2 days to weevils, and these samples treated with Imidan, large numbers of weevils completed their development and emerged in every sample (Table 3). Only the Imidan treatment applied on the 35th day, when many weevils were enlarging their exit hole, significantly reduced the number of weevils emerging.

Table 3.—Number of adult weevils emerging from 15 sweet potatoes treated with Imidan on indicated day after being infested with eggs.

Day	5	10	15	20	25	30	35
Adults emerged[1]	354	278	426	471	440	329	106

[1]Untreated sweet potatoes produced 485 adult weevils.

Persistance of Imidan treatment

Imidan applied to uninfested sweet potatoes remained highly effective through the 99-day test in killing adult weevils and in reducing the number of punctures (Table 4). Weevils exposed to Imidan-treated potatoes suffered nearly complete mortality within a day, and the number of punctures in the treated potatoes was less than a tenth the number in untreated potatoes during the 1-day exposure period.

Table 4.—Effect of Imidan treated sweet potatoes on mortality and feeding of adult weevils.

Age (days) of Imidan residue	% mortolity after 1 doy		Number of punctures per weevil after 1 day	
	Imidan	Check	Imidon	Check
12	99.5	2.5	.3	3.6
66	99.5	0	.2	3.6
99	99.8	2.9	.1	2.9

Insecticides applied at bedding

Plants grown from weevil-infested sweet potatoes were protected to a considerable degree by Furadan and by Dasanit banded over the furrow before the sweet potatoes were covered (Table 5). The other insecticides and a low rate of Furadan were much less effective in reducing the number of weevil eggs inserted into the plants. The infestation in plants from untreated plots was very high, amounting to 87 eggs in 100 plants.

Table 5.—Reduction of infestation in plants by banding insecticides over infested sweet potatoes in furrow before covering with soil.

Treatment		Eggs in 100 slips		
Insecticide & formulation	Active ingredient per ocre (lbs.)	First pulling	Second pulling	Sum
Furodan, 10G	3	2	1	3
Dosonit, 15G	2.5	2	3	5
Mocop, 10G	3	18	2	20
Dyfonote, 10G	3	14	7	21
Furadan, 10G	1.5	15	7	22
Dyfanate, 10G	1.5	12	12	24
Mocap, 10G	1.5	35	12	47
Thiodan, 50W	1	29	27	56
Check	—	68	19	87

Foliar sprays on plant bed

All of the insecticides tested as foliar applications to a plant bed reduced the incidence of infested plants drastically (Table 6). There was no statistically significant difference among the treatments.

Table 6.—Reduction of weevil infestation in plants by controlling adult weevils in plant bed with weekly applications of insecticide.

Treatment			
Insecticide & formulation	Active Ingredient per acre (lbs.)	Percent plants infested	Number of eggs and larvae in 60 slips
Dyfonate, 4E	1.5	1	2
	.75	0	0
Furadan, 4F	.25	3	5
Imidan, 70W	1.0	3	5
Thimet, 50W	.5	0	0
Check	—	35	42

Cut vs. pulled plants

Cutting plants an inch or more above soil level rather than pulling "draws" or "slips" increased the percentage of weevil-free plants from 38 percent to 98 percent (Table 7). In 60 cut plants, only one egg was present; in 60 pulled plants, the 37 infested plants contained a total of 69 weevil eggs.

Table 7.—Infestation of sweetpotato weevil eggs in 60 slips or cut plants from plant bed established with heavily infested sweet potatoes.

Number of eggs in plant stem	% slips infested	% cut plants infested
0	38	98
1	33	2
2	15	
3	10	
6	2	
7	2	

Conclusion

Infestations of the sweetpotato weevil in planting material can be virtually eliminated by using an appropriate combination of practices.

The risk of infestation in storage is minimized by: (1) storing bedding sweet potatoes in a building reserved for this purpose that has been cleaned soon after sweet potatoes were removed the previous year, (2) treating the interior surfaces of the storage house with malathion, and (3) treating sweet potatoes at harvest with Imidan.

No adult weevil lived more than 5 days without food at ambient summer temperatures in southern Louisiana. Whole potatoes and fragments that serve as food for sweetpotato weevils are easily removed from storage houses. Fibrous roots did not sustain weevils and are of no consequence. Cleaning storage houses soon after sweet potatoes are bedded and leaving them empty through the summer assures freedom from any residual infestation at harvest.

A residual treatment of malathion spray applied to all interior surfaces of a storage house is additional protection from adult weevils that may be carried inadvertently into the storage house along with sweet potatoes or equipment or that may otherwise gain entrance. Although both carbofuran and malathion residues on wooden surfaces destroyed nearly all adult weevils exposed to them and remained effective for at least 4 weeks, malathion is preferable for the safety of the applicator. A rather low dosage of malathion was effective against the weevil, but a rate of .625 pounds of malathion (1 pint of 5EC formulation) is required to control both the weevil and the smokey brown roach. A residual spray applied at this rate to all interior surfaces of a storage house caused no detectable residue in crated sweet potatoes that were placed in storage as soon as the spray dried.

The most important single method of minimizing infestations in storage is the application of Imidan dust to sweet potatoes at harvest. This protectant does not prevent immature weevils which may already be present within sweet potatoes from continuing their development. It does, however, destroy emerging adult weevils before they complete their preoviposition period and start another generation in storage. Additional damage to the stored sweet potatoes is therefore limited to a few inconsequential feeding punctures. The effectiveness of Imidan applied at a rate equivalent to 3 ounces of 5 percent dust per 50-pound bushel was undiminished after 99 days. In practice this is more than sufficient time for all adults to emerge from sweet potatoes that are already infested at harvest.

In the event that weevil-infested sweet potatoes must be used for bedding, plants from these sweet potatoes can be protected to an appreciable degree by an application of Dasanit at the time of bedding. The insecticide is applied in a band that includes not only the sweet potatoes laid in the furrow but also the soil along both sides of the forrow used to cover them. Modification of the application method would be necessary for wide beds. Although Furadan at the rate of 3 pounds per acre is comparable to Dasanit in protection afforded, only Dasanit at a maximum rate of 2.6 pounds per acre in an 18-inch band is approved for this usage. Application of Dasanit at the time of bedding should be reserved for those instances when weevil-infested sweet potatoes must be used for bedding. It should not be a routine practice.

Even though bedding sweet potatoes are uninfested, and plant beds are isolated as far as practicable from potential sources of infestation, some adult weevils may fly into plant beds. The incidence of infestation in plant beds is much reduced by weekly foliar applications of insecticide to the plant bed. Since adult weevils concentrate near the soil surface, a volume of spray sufficient to penetrate the canopy of leaves and wet the plant stems is necessary to assure a high level of control. Although Dyfonate, Furadan, Imidan, and Thimet were equally effective at the rates used, only Thimet at .5 pound of active ingredient per acre is approved as a foliar application on sweet potatoes.

A final precaution should be taken to avoid transferring infestations from the plant bed to increase or production fields. Since nearly all weevil eggs in plant stems are located near the soil surface, cutting plants an inch or more above the soil surface leaves almost all eggs and larvae in the plant bed. In this experiment the percentage of weevil-free plants was increased from 38 to 98 by cutting. Cutting plants also reduces the probability of transferring the reniform nematode[5], root knot nematodes[6], and several soil-borne diseases, especially black rot[7], foot root[8], and scurf[9].

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[5]*Rotylenchulus reniformis* Linford and Oliveria.
[6]*Meliodogyne* spp.
[7]*Ceratocystis fimbriata* Ell. and Halst.
[8]*Plenodomus destruens* Harter.
[9]*Monilochaetes infuscans* Ell. and Halst, ex Harter.

Literature Cited

1. Cockerham, K. L., O. T. Deen, M. B. Christian and L. D. Newsom. 1954. The biology of the sweet potato weevil. La. Tech. Bull. no. 483.
2. Reinhard, H. J. 1923. The sweet potato weevil. Tex. Agr. Expt. Sta. Bull. no. 308.